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Abstract

Background: Needlestick injury (NSI) is a significant occupational health issue among healthcare workers (HCWs).

Aims: To determine the national self-reported incidence and risk factors for NSI among Malaysian Ministry of Health (MOH) HCWs.

Methods: Using data from the MOH national sharps injury surveillance programme, information on reported NSIs over a 1-year period (2016) for different HCW subgroups were extracted and analysed.

Results: A total of 1234 NSI cases were reported in 2016, giving an overall incidence of 6 injuries per 1000 HCWs. Medical doctors recorded the highest incidence (21.1 per 1000 HCWs) followed by dental staff (7.5), pharmacy staff (4.2), nurses (3.7), medical assistants (3.4) and allied and auxiliary staff (1.0). Doctors had significantly increased risk of NSI compared with allied and auxiliary staff (relative risk [RR], 20.7, 95% confidence interval [CI] 15.5-27.5), medical assistants (RR=6.1, 95% CI 4.5-8.2), nurses (RR=5.7, 95% CI 5.0-6.6), pharmacy staff (RR=5.0, 95% CI 3.7-6.6), and dental staff (RR=2.8, 95% CI 2.2-3.5). Significant differences were found in age and sharps-handling experience between occupational subgroups ($p<0.001$ for both variables). Male employees had higher risk than females (RR=1.33, 95% CI 1.18-1.50), with a significant difference seen in their sharps-handling experience ($p<0.01$). Important risk factors included unsafe practices such as recapping of needles and their improper disposal.

Conclusions: The national incidence of NSI amongst Malaysian HCWs was lower compared with other countries, but unsafe practices remain an important concern. There is a need to formulate, implement and monitor safe and consistent practices for the different healthcare professionals.

Key words: needlestick injuries, Malaysia, health care workers

Introduction

Sharps injury, particularly needlestick injury (NSI) has been identified as one of the most significant occupational health issues in the health sector, especially among healthcare workers (HCWs) [1,2]. The most worrying consequence of NSIs is the transmission of blood-borne pathogens such as HIV, hepatitis B virus (HBV) and hepatitis C virus (HCV) [3]. A large proportion of HIV, HBV and HCV infections amongst HCWs are attributed to injuries due to contact with sharp instruments contaminated by blood and bodily fluids [4]. The transmission rates for HBV, HCV and HIV following percutaneous exposure are estimated to be 30%, 1.8% and 0.3% respectively, with only HBV being preventable through immunisation [5]. NSI is one of the national indicators in the health quality assurance programme under the Ministry of Health Malaysia (MOH), with zero incidence set as the target, on the basis that it is largely preventable [6].

The majority of the studies on NSI are cross-sectional surveys measuring prevalence in different healthcare facilities and amongst different HCWs [7-10]. Published studies on the incidence of NSIs provide a range of inconsistent estimates, mainly due to the lack of standardised approach for reporting and calculating NSI [11]. The evidence on the incidence of NSI in Malaysia is in still its infancy, however with improvements, the goal is to establish reliable data to inform both national prevention strategies and the identification of appropriate workplace interventions. Although several site specific cross-sectional studies on NSI have been conducted in Malaysia [12-14], the most recent study on NSI incidence was published over a decade ago [15]. Given the sparse national data, the aims of this study were to determine the latest incidence of NSI among HCWs in Malaysia and explore the relative risk by gender and HCW subgroups. Furthermore, we also investigated the demographic and work practice related risk factors for NSI.

Methods

This study screened and analysed data from the national sharps injury surveillance (SIS) programme run by the MOH Malaysia. The programme was introduced to monitor the

occurrence of sharps and needlestick injuries in the government health facilities [16]. The SIS programme requires any HCW who sustains a sharp injury (including NSI) at any MOH health facility to voluntarily report to the locally appointed area supervisor immediately (within 24 hours from the time of injury). The injured worker is then referred to a designated medical officer or specialist for further assessment. When indicated, investigations of blood-borne viruses are conducted, and post-exposure prophylaxis is given immediately if the case is considered to be high-risk [17]. Subsequently, the occupational health or infectious disease unit from the same health facility conducts a case investigation using a standard reporting form known as OHU/SIS-1 [16]. This form comprises of questions on the worker's demographics (e.g. age, gender), location of injury, job category, type of device used and the reported cause of injury.

OHU/SIS-1 forms from all MOH health facilities in the entire country (including hospitals and non-hospitals such as community health clinics and research institutes) are collated by the MOH occupational health unit (OHU). For this study, we used the OHU/SIS-1 data on all reported sharps injury over a 12 month period (from 1st January 2016 to 31st December 2016). The number of MOH employees by gender and job titles was obtained from the OHU. Ethical approval for the collation and analysis of data was attained from the Medical Research and Ethics Committee of the MOH.

Only injuries caused by a needle instrument (e.g. hypodermic needles, intravenous cannula and suture needles) were selected, while other sharps injuries (e.g. glass and surgical instruments) were omitted. We excluded workers who were not directly employed by MOH (e.g. housekeeping staff), students (e.g. medical and nursing students), and certain occupations that were considered at low-risk of NSI (e.g. storekeepers, administrative staff and kitchen staff). The HCWs were categorised into six subgroups: medical doctors, nurses, medical assistants, dental staff, pharmacy staff and allied and auxiliary staff (Table 1). The overall cumulative incidence of NSI was calculated using the following formula [number of reported NSIs (n)/number of employees in 2016 (N) x 1000 HCWs], along with gender and job-specific incidence rates and the corresponding relative risks (RR). Demographic

information of the affected workers and workplace risk factors leading to injuries were analysed. Bivariate analysis was conducted using Mann-Whitney U, Kruskal-Wallis and Pearson's chi-squared tests. All analysis was performed using SPSS version 21 with a 5% significance level applied.

Results

A total of 1234 cases of NSI were reported in 2016. The median age of the workers was 27.0 years (IQR 25.0-30.0) and the median experience of handling sharps equipment was 1.8 years (IQR 0.5-5.0). Seventy percent of the NSI incidents occurred in female employees and the majority of cases (54%) were reported by medical doctors (Table 2). Eighty-six percent of the injuries occurred in the hospital environment, the hospital ward being the most common site of occurrence (57%), followed by the operating theatre and intensive care unit (19%), and the labour room and emergency department (12%). Overall, injuries most commonly occurred between 6.00 a.m. and 12.00 p.m. (38%) while the lowest proportion of the injuries occurred between 12.00 a.m. and 6.00 a.m. (12%). The majority (93%) of incidents were reported within 24 hours from the time of injury. Most cases involved hollow-bore needles (81%), with needles contaminated with either blood or bodily fluids (96%). Drawing blood and bodily fluid was the most common task reported as the cause of injury (29%), followed by administering injection (26%), surgical procedure (18%), and setting intravenous (IV) line (13%). Other non-specific tasks (14%) include finger prick for glucose monitoring or cleaning of instruments.

Table 3 illustrates the circumstances leading to NSIs. Most cases occurred when the needles were used during a medical procedure (42%) most occurring during needle withdrawal. Handling of needle equipment after use and before disposal (22%) was the next most common circumstance of injury, with recapping or disassembling the equipment being the major contributor in this category. Seventeen percent of incidents occurred during surgical procedures or in the operating theatre, and the majority of these were during suturing. Injuries that occurred due to being stuck by needles placed at inappropriate

locations accounted for 7% of cases, of which the most common locations were on the table or tray. Situations relating to equipment disposal accounted for 6% of incidents, with the majority of the injuries occurred when disposing of the needle equipment. Other circumstances accounted for 6% of cases and included being stuck with a needle during a collision, or accidentally dropping equipment.

The 1234 NSI cases reported among 207,157 MOH employees from six occupational subgroups equates to an overall incidence of 6.0 injuries per 1000 HCWs. The highest incidence was among medical doctors (21.1 injuries per 1000 HCWs), followed by dental staff (7.5), pharmacy staff (4.2), nurses (3.7), medical assistants (3.4) and allied and auxiliary staff (1.0) (Figure 1). Medical doctors had an increased risk of NSI compared with allied and auxiliary staff (relative risk [RR]=20.7, 95% CI 15.5-27.5), nurses (RR=5.7, 95% CI 5.0-6.6), medical assistants (RR=6.1, 95% CI 4.5-8.2), pharmacy staff (RR=5.0, 95% CI 3.7-6.6), and dental staff (RR=2.8, 95% CI 2.2-3.5). Bivariate analysis revealed significant differences in age and sharps-handling experience between the six occupational subgroups ($p<0.001$ for both variables, Table 4). Medical assistants and doctors were the two youngest groups (median age 25.5 years and 26.0 years respectively) with doctors having the least experience (median experience 1.0 year).

Male HCWs had a higher incidence of NSI (with and incidence of 7.3 injuries per 1000 HCWs, and a 33% increased risk of injury compared with female employees (incidence 5.5 per 1000 HCWs) with a RR male to female of 1.33, 95% CI 1.18-1.50. There was no significant difference in age distribution by gender (median age: male=27.2 years, female=27.0 years) (Table 4). However, female employees had significantly more experience in handling sharps compared with males (median experience: male=1.3 years, female=2.0 years, $p<0.01$). In addition, the proportion of medical doctors amongst male employees (253/372, 68%) was higher than that of females (419/862, 49%).

The distribution of gender, time of injury, and tasks by HCW subgroups are detailed in Table 5.. In most subgroups, the injuries occurred between 6.00 a.m. and 11.59 a.m., except for medical doctors (34% 12.00 p.m.-5.59 p.m.) and medical assistants (35% 6.00 p.m.-11.59

p.m.). The highest proportion of injuries among dental staff and nurses occurred when administering injections (46% and 43% respectively), while majority of doctors sustained the injuries when drawing blood or body fluid (42%) and conducting surgical procedures (22%). Most pharmacists were injured doing non-specific tasks such as handling insulin needles (78%). The differences of gender, time of injury and tasks between occupational subgroups were statistically significant ($p<0.001$ for the three variables).

Discussion

In this study, the overall incidence of NSI among MOH employees was 6.0 injuries per 1000 HCWs with medical doctors having the highest incidence. Significant differences were found in the age and sharps-handling experience between different groups of HCWs. This incidence is similar to the incidence reported in a previous Malaysian study in 2003 (6.5 per 1000 HCWs) [15]. However, the latter was limited to one state in Malaysia and did not include HCW groups such as pharmacists and laboratory technicians.

Our estimate is low compared with other countries; a US review estimated the incidence of NSI between 23 and 103 injuries per 1000 HCWs for studies that relied on self-reporting [18], and a similar UK study auditing 15 National Health Service occupational health departments, reported rates between 9 and 44 NSIs per 1000 HCWs per year [19]. Other studies from Canada, Saudi Arabia and Germany have reported incidence rates of 17, 33 and 69 per 1000 workers respectively [20-22]. These discrepancies may be due to differing study designs, HCWs groups studied and methods for reporting injuries.

Since the Malaysian SIS programme depends on voluntary reporting, it is likely that a proportion of injuries are not reported, which may underestimate the true incidence of NSI. In this study, the level of under-reporting was not investigated, however it remains a significant problem amongst HCWs [11]. For example, several studies have estimated the rate of under-reporting between 42% and 59% [8,9,12,13], with rates of injury from studies relying on self-reporting being up to 10 times lower than prospective studies [23]. Common reasons

for not reporting are: low perception of risk, embarrassment, fear of the consequences, and poor understanding of the reporting system [7-10].

Consistent with findings in another Malaysian study, male workers in this study had significantly increased risk of NSI, [14]. However, in other international studies, female workers were shown to have up to double the risk of sustaining NSI compared with males [20,24]. The higher incidence amongst males in our study may be explained by female HCWs having more sharp-handling experience and a higher proportion of doctors being male who were also younger and were least experienced in handling sharps. The high proportion of doctors in our study population also explains our sample's young median age; the majority of doctors were house officers, who typically enter the workforce between the age of 25 and 27, and undergo compulsory internships for at least 2 years. Their young age and inexperience may synergistically predispose them to making errors leading to NSI. A study from Singapore found a higher NSI incidence among doctors compared to nurses [25], while in the UK, doctors and nurses almost equally contributed to the majority of NSIs over a 10-year period [26]. Other studies have shown that the risk for NSI decreases as age increases [20,24], and lack of clinical experience has been associated with higher NSI prevalence [8].

Dental and pharmacy staff recorded a high incidence of NSI; this could be due to inexperience, as dental staff had the second lowest sharps-handling experience. One study argued that dental professionals are at risk of NSI due to multiple injections given over the course of some treatments [27]. The high occurrence of NSI among pharmacy staff was unexpected due to their infrequent direct-patient care compared with nurses. In the US, NSIs were reported among pharmacists in retail pharmacy chains who administered vaccinations [28], however in Malaysia, vaccinations are normally given by nurses or doctors. Pharmacists in MOH do routinely provide demonstration of insulin pen usage to diabetes mellitus patients and may sustain NSIs when disassembling the equipment. Further studies investigating NSI and risk factors for these group are needed.

In this study, harmful practices such as recapping or re-sheathing used needles, and improper disposal of needles were found to be prevalent. This is concerning since recapping is considered unsafe and has been shown to be an important risk factor in many studies [8,10,15,24,29]. These practices may be prevented by using safety-engineered needle devices, which have been shown in recent studies to reduce the incidence of NSIs by up to 22% respectively [21,30]. Nevertheless, more research on the feasibility and effectiveness of these devices is needed as data on their use in Malaysia are lacking.

The main strength of this study is its wide coverage of all government-owned health facilities and most at-risk HCW groups including dental and pharmacy staff who have not been investigated previously in Malaysia. This is the largest and most up-to-date study on the incidence of NSI in Malaysia, utilising for the first time, the national surveillance data. Nevertheless, our data was limited to self-reported cases by HCWs and we did not investigate the attitude of employers, work practices and local enforcement of policies on NSI notification, which important factors in reporting. Furthermore, our study only represents government sector HCWs, due to the lack of a standardised NSI reporting system in the private sector.

In summary, the incidence of NSI in Malaysia is low compared with studies from other countries; unsafe practices remain an important concern which could be addressed through workplace risk assessments, education and training for HCWs. Further research on the overall notification process is needed to identify barriers preventing HCWs from reporting injuries, and to improve the NSI surveillance program in Malaysia.

Key points:

- The overall incidence of needlestick injury amongst health care workers in Malaysia was lower compared with other international studies.
- Medical doctors were at the highest risk of NSI; however high incidence rates were also found in dental and pharmacy staff who are less often studied.

- Unsafe practices such as recapping and improper disposal of needles were among important factors contributing to NSI.

Competing interests: None declared.

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References

1. Vijendren A, Yung M, Sanchez J. Occupational health issues amongst UK doctors: a literature review. *Occup Med (Lond)* 2015;**65**:519-528.

2. Dulon M, Lisiak B, Wendeler D, Nienhaus A. Causes of needlestick injuries in three healthcare settings: analysis of accident notifications registered six months after the implementation of EU Directive 2010/32/EU in Germany. *J Hosp Infect*. 2017;**95**:306-311.

3. Elseviers MM, Arias-Guillén M, Gorke A, Arens HJ. Sharps injuries amongst healthcare workers: review of incidence, transmissions and costs. *J Ren Care*. 2014;**40**:150-6.

4. Prüss-Üstün A, Rapiti E, Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *Am J Ind Med.* 2005;**48**:482-90.

5. Beltrami EM, Williams IT, Shapiro CN, Chamberland ME. Risk and management of blood-borne infections in health care workers. *Clin Microbiol Rev* 2000;**13**:385-407.

6. Badaruddin NK, Awang S, Ahmad S, Hamidi N, Sudharshana M. *Quality Assurance Programme Technical Report 2016.* Selangor, Malaysia: Institute for Health Systems Research, Ministry of Health M, 2017.

7. Choi LY, Torres R, Syed S, *et al*. Sharps and needlestick injuries among medical students, surgical residents, faculty, and operating room staff at a single academic institution. *J Surg Educ.* 2017;**74**:131-136.

8. Azadi A, Anoosheh M, Delpisheh A. Frequency and barriers of underreported needlestick injuries amongst Iranian nurses, a questionnaire survey *J Clin Nurs*. 2011;**20**:488-493.

9. Elmiyeh B, Whitaker I, James M, Chahal C, Galea A, Alshafi K. Needle-stick injuries in the National Health Service: a culture of silence. *J R Soc Med.* 2004;**97:**326–327.

10. Talaat M, Kandeel A, El-Shoubary W, *et al*. Occupational exposure to needlestick injuries and hepatitis B vaccination coverage among health care workers in Egypt. *Am J Infect Control.* 2003;**31**:469-74.

11. Trim J, Elliott T. A review of sharps injuries and preventative strategies. *J Hosp Infect.* 2003;**53**:237-242.

12. Lee LK, Noor Hassim I. Implication of the prevalence of needlestick injuries in a general hospital in Malaysia and its risk in clinical practice. *Environ Health Prev Med.* 2005;**10**:33–41.

13. Ng, W. and Noor Hassim, I. (2007). Needlestick Injury among medical personnel in Accident and Emergency Department of two teaching hospitals. *Med J Malaysia.* 2007;**62**:9-12.

14. Bhardwaj A, Sivapathasundaram N, Yusof M, Minghat A, Swe K, Sinha N. The prevalence of accidental needle stick injury and their reporting among healthcare workers in orthopaedic wards in general hospital Melaka, Malaysia. *Malays Orthop J.* 2014;**8**:6-13.

15. Mohd Faid A, Zainudin M, Yusmah M, Norizah M, Rosnah I. Needle stick injuries among health care workers in Negeri Sembilan. *MJPHM*. 2005;**2**:10-14.

16. Occupational Health Unit (OHU). *Sharps Injury Surveillance*. Putrajaya, Malaysia: OHU, Ministry of Health M, 2007.

17. Occupational Health Unit (OHU). *Guidelines on Occupational Exposures to Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV) and Hepatitis C Virus, and Recommendations for Post Exposure Prophylaxis (PEP)*. Putrajaya, Malaysia: OHU, Ministry of Health M, 2007.

18. Lee JM, Botteman MF, Xanthakos N, Nicklasson L. Needlestick injuries in the United States. Epidemiologic, economic, and quality of life issues*. AAOHN J.* 2005;**53**:117-33.

19. Smedley J, Coggon D, Heap D, Ross A. Management of sharps injuries and contamination incidents in health care workers: an audit in the Wessex and Oxford regions. *Occup Med (Lond)* 1995;**45**:273–275.

20. Alamgir H, Cvitkovich Y, Astrakianakis G, Yu S, Yassi A. Needlestick and other potential blood and body fluid exposures among health care workers in British Columbia, Canada. *Am J Infect Control.* 2008;**36**:12-21.

21. Hoffmann C, Buchholz L, Schnitzler P. Reduction of needlestick injuries in healthcare personnel at a university hospital using safety devices. *J Occup Med Toxicol.* 2013;**8**: 20.

22. Memish Z, Almuneef M, Dillon, J. Epidemiology of needlestick and sharps injuries in a tertiary care center in Saudi Arabia. *Am J Infect Control.* 2002;**30**:234-241.

23. Elder A, Paterson C. Sharps injuries in UK health care: a review of injury rates, viral transmission and potential efficacy of safety devices. *Occup Med (Lond).* 2006;**56**:566-74.

24. Pournaras S, Tsakris A, Mandraveli K, Faitatzidou A, Douboyas J, Tourkantonis A. Reported needlestick and sharp injuries among health care workers in a Greek general hospital. *Occup Med (Lond).* 1999;**49**:423-426.

25. Ng L, Lim H, Chan Y, Bin Bachok D. Analysis of sharps injury occurrences at a hospital in Singapore. *Int J Nurs Pract.* 2002;**8**:274-281.

26. Woode Owusu M, Wellington E, Rice B, Gill ON, Ncube F. *Eye of the Needle; United Kingdom Surveillance of Significant Occupational Exposures to Bloodborne Viruses in Healthcare Workers.* London: Public Health England, 2014.

27. Shah SM, Merchant AT, Dosman JA. Percutaneous injuries among dental professionals in Washington State. *BMC Public Health*. 2006;**6:**269.

28. de Perio MA. Needlestick Injuries among employees at a nationwide retail pharmacy chain, 2000–2011.*Infect Control Hosp Epidemiol*. 2012 ;**33**:1156–1158.

29. Bi P, Tully PJ, Boss K, Hiller JE. Sharps injury and body fluid exposure among health care workers in an Australian tertiary hospital*. Asia Pac J Public Health*. 2008;**20**:139-47.

30. Lu Y, Senthilselvan A, Joffe A, Beach J. (2014). Effectiveness of safety-engineered devices in reducing sharp object injuries. *Occup Med (Lond).* 2015;**65**:39-44.

Table 1. Occupational HCW subgroups and numbers employed by MOH

Occupational subgroups	Corresponding job titles	Number of employees in 2016 (N)
Medical doctors	House officer, medical officer, medical specialist, medical consultant	31,878
Nurses	Matron, sister, staff nurse, community nurse, midwife	89,151
Medical assistants	Medical assistant	13,357
Pharmacy staff	Pharmacist, pharmacy assistants	12,048
Dental staff	Dental officer, dental specialist, dental nurse, dental technician, dental surgery assistant	11,705
Allied and auxiliary staff	Driver, radiology staff, medical laboratory technician, laboratory assistant, health inspector, health and dental attendant	49,018
Total		207,157

Table 2. Demographic and work-related factors associated with NSI

Variables	n (%)
Gender	
Male	372 (30)
Female	862 (70)
Job subgroup	
Medical doctors	672 (54)
Nurses	327 (27)
Medical assistants	46 (4)
Pharmacy	51 (4)
Dental	88 (7)
Allied and auxiliary	50 (4)
Location of injury	
Hospital	1060 (86)
Non-hospital*	174 (14)
Location of injury within hospital	
Ward	602 (57)
Labour room & emergency department	133 (12)
Intensive care unit & operating theatre	201 (19)
Others	124 (12)
Time of injury	
12.00 am-5.59 am	148 (12)
6.00 am-11.59 am	471 (38)
12.00 pm-5.59 pm	395 (32)
6.00 pm-11.59 pm	214 (18)
Reporting time	
≤ 24 hours	1149 (93)
> 24 hours	85 (7)
Type of needle device	
Hollow-bore	1000 (81)
Blunt	228 (19)
Device contamination	
Contaminated	1190 (96)
Not contaminated	10 (1)
Unsure	34 (3)
Task	
Giving injection	319 (26)
Drawing blood/fluid	364 (29)
Setting IV line	160 (13)
Surgical procedure	222 (18)
Other	169 (14)

*E.g. community health clinics, research institutes

Table 3. Circumstances leading to NSI

Circumstances of injury	n (%)
Use in medical procedure	516 (42)
Needle insertion/manipulation	157 (13)
Needle withdrawal	235 (19)
Transfer of equipment	124 (10)
After use and before disposal	275 (22)
Recapping/disassembling equipment	88 (7)
Transfer of equipment/blood	83 (7)
In transit to disposal	45 (3)
Other	59 (5)
Use in surgical procedure	213 (17)
Suturing	181 (14)
Passing/receiving equipment	25 (2)
Other	7 (1)
Needle left at inappropriate places	87 (7)
Table/tray	40 (3)
Bed/mattress	14 (1)
Other	33 (3)
During disposal	77(6)
Disposing equipment	57 (4)
Emptying/manipulating sharps bin	13 (1)
Defective/overfilled sharps bin	7 (1)
Other	66 (6)

Table 4. Age and sharps-handling experience by gender and occupational subgroups

Variable	Age (years)	Sharps-handling experience (years)
	Median (IQR)	Median (IQR)
Gender		
Male	27.2 (25.0-29.0)	1.3 (0.4-4.0)
Female	27.0 (25.0-30.0)	2.0 (0.6-5.0)
Mann-Whitney	$Z = -0.16^{NS}$	Z = -2.77**
Job subgroup		
MD	26.0 (25.0-29.0)	1.0 (0.3–3.0)
Nurses	27.0 (24.0-32.0)	3.0 (1.0-5.3)
MA	25.5 (24.0-29.0)	3.0 (1.0-5.3)
Pharmacy	28.0 (25.0-30.0)	5.0 (1.1-6.0)
Dental	27.0 (25.0-29.0)	1.5 (0.8-4.3)
AA	32.5 (28.0-42.0)	6.5 (4.0-15.0)
Kruskal-Wallis	$\chi^2 = 68$***	$\chi^2 = 165$***

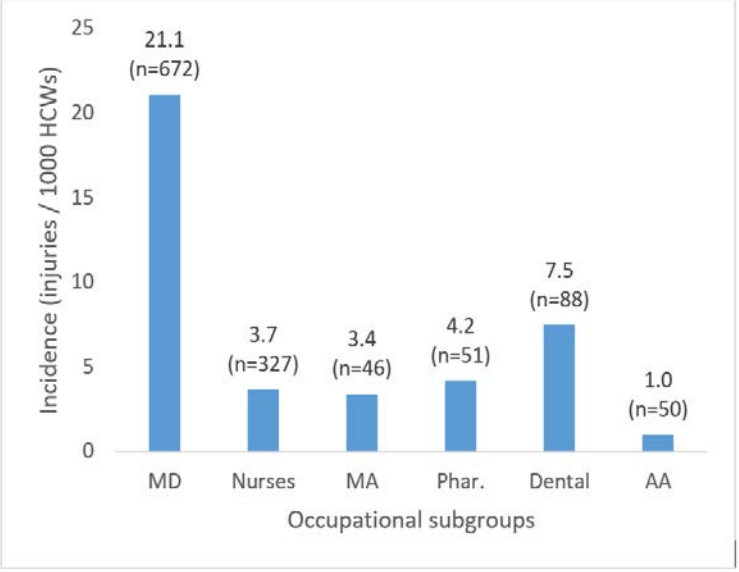
χ2=chi-squared value, NS=not significant, ***P*<0.01, ****P*<0.001

Table 5. Gender, time of injury and task by occupational subgroups

Variable	MD	Nurses	MA	Phar.	Dental	AA	χ^2
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Gender							
Male	253 (38)	23 (7)	38 (83)	6 (12)	23 (26)	29 (58)	188***
Female	419 (62)	304 (93)	8 (17)	45 (88)	65 (74)	21 (42)	
Time of injury							
12.00 am-5.59 am	99 (15)	34 (10)	5 (11)	0 (0)	7 (8)	3 (6)	
6.00 am-11.59 am	210 (31)	140 (43)	15 (33)	31 (61)	50 (57)	25 (51)	65***
12.00 pm-5.59 pm	228 (34)	100(31)	10 (22)	17 (33)	24 (27)	16 (33)	
6.00 pm-11.59 pm	132 (20)	51 (16)	16 (35)	3 (6)	7 (8)	5 (10)	
Task							
Giving injection	105 (16)	140 (43)	17 (37)	9 (18)	40 (46)	8 (16)	
Drawing blood/fluid	280 (42)	64 (20)	7 (15)	1 (2)	2 (2)	10 (20)	511***
Setting IV line	116 (17)	36 (11)	6 (13)	0 (0)	0 (0)	2 (4)	
Surgical procedure	150 (22)	39 (12)	9 (20)	1 (2)	20 (23)	3 (6)	
Other	21 (3)	48 (14)	7 (15)	40 (78)	26 (29)	27 (54)	

χ^2=chi-squared value, ***P<0.001

Figure 1. Incidence of NSI between occupational subgroups



MD=medical doctors, MA=medical assistants, Phar.=pharmacy staff
Dental=dental staff, AA=allied and auxiliary staff